

## WHAT IS CLAIMED IS:

1. An X-ray microscope apparatus comprising;  
an X-ray generator;

a photocathode disposed on a path of X-rays generated by the X-ray generator, the photocathode being configured to produce electrons when irradiated with X-rays generated by the X-ray generator so that an electron image of a specimen held on the photocathode is formed;

an electron image enlarging device configured to enlarge the electron image of the specimen, the electron image enlarging device including an acceleration anode configured to accelerate electrons produced by the photocathode and a magnetic lens configured to enlarge and focus an electron beam of electrons emitted by the photocathode;

an electron beam detecting device configured to detect an electron beam focused thereon by the electron image enlarging device; and

an image processing device configured to process an electron image formed by the electron beam detecting device so as to provide a visible image.

2. The X-ray microscope apparatus according to claim 1, wherein the X-ray generator is a synchrotron radiation source.

3. The X-ray microscope apparatus according to claim 1, wherein the X-ray generator is an electron-beam-excited X-ray generator.

4. The X-ray microscope apparatus according to claim 1, wherein the X-ray generator is an electric-discharge-excited X-ray generator.

5. The X-ray microscope apparatus according to claim 1, wherein the X-ray generator is a laser-plasma X-ray generator including a laser and capable of generating X-rays by irradiating a target with a laser beam.

6. The X-ray microscope apparatus according to claim 5, wherein X-rays generated by the X-ray generator is applied directly to the photocathode.

7. The X-ray microscope apparatus according to claim 5, wherein the X-ray generator is provided with an X-ray condensing device capable of condensing X-rays generated by the X-ray generator so that condensed X-rays are applied to the photocathode.

8. The X-ray microscope apparatus according to claim 5, wherein the target is covered with a protective target cover made of a thin film capable of transmitting X-rays.

9. The X-ray microscope apparatus according to claim 8, wherein the protective target cover is formed of a material that transmits X-rays of wavelengths in a range of 2.3 to 4.4 nm effectively.

10. The X-ray microscope apparatus according to claim 5, wherein the laser and the electron image enlarging device are disposed such that an axis of the laser beam emitted by the laser and an axis of the electron beam used by the electron image enlarging device are parallel.

11. The X-ray microscope apparatus according to claim 10, wherein the axis of the laser beam emitted by the laser and the axis of the electron beam used by the electron image enlarging device are included in a common horizontal plane.

12. The X-ray microscope apparatus according to claim 10, wherein the axis of the laser beam emitted by the laser and the axis of the electron beam used by the electron image enlarging device are included in a common vertical plane.

13. The X-ray microscope apparatus according to claim 12, wherein the laser is disposed below the electron image enlarging device, and a power supply unit for supplying power to the laser and an evacuating unit for evacuating the X-ray generator are disposed below the laser.

14. The X-ray microscope apparatus according to claim 5, wherein the electron image enlarging device is set such that an axis of the electron beam is vertical.

15. The X-ray microscope apparatus according to claim 14, wherein the X-ray generator is disposed above the electron image enlarging device.

16. The X-ray microscope apparatus according to claim 14, wherein X-ray generator is disposed below the electron image enlarging device.